

HISTORY OF CHEMISTRY AS A TOOL FOR THE ENGAGEMENT OF UNDERREPRESENTED STUDENTS IN CHEMISTRY

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Abstract

How can the history of chemistry be an effective tool for the recruitment and retention of underrepresented students in chemistry? How can the history of chemistry address equity in the classroom? We will explore how the stories of historically underrepresented chemists can be used to attract more diverse students into the discipline.

“I am making [an] application for a Fellowship with the National Research Council for the year 1933-34. I should greatly appreciate if you would kindly write a letter of recommendation for me,” Dr. Percy L. Julian wrote to then Harvard Professor Elmer P. Kohler in February 1933 (1). Around this time, Julian’s first paper (2) with fellow chemist and colleague, Josef Pikl had just been accepted for publication in the *Journal of the American Chemical Society (JACS)*, a highly prestigious scientific journal. Julian wanted to continue his research efforts at DePauw University and he needed to provide financial support for his aging parents.

I am compelled to contribute 50 dollars per month to the maintenance of my parents now, and since there are facilities here for work, the library being very complete and since working conditions are so pleasant, I could very well carry out my work, live at home and avoid any suffering on the part of my parents wrote Julian.

Julian’s career as a chemist was quite different from Saint Elmo Brady’s, who was the first African American

to earn a Ph.D. in chemistry in 1916 from the University of Illinois at Urbana Champaign. Brady spent his entire career teaching at HBCUs (Historically Black Colleges and Universities) mentoring several future chemists during his academic career. A recent publication authored by a former student of Brady’s discusses his impact on HBCUs and chemical education (3). After earning his Ph.D. in 1931 from the University of Vienna, Julian was only the third African American to earn a doctoral degree in chemistry and he was determined to engage in cutting-edge research, but obstacles and significant barriers were always in his path.

Kohler responded to Julian a week later (1) emphasizing that he would likely not receive such a fellowship. “If I were you, I should not put too much hope in the outcome,” Kohler wrote. Furthermore, Kohler indicated that the fellowships are often provided to give “exceptional young men an opportunity to perfect themselves in their craft.” Julian was only 33 years old at this time.

Although Kohler did not say no to Julian’s request for a letter of support, he did suggest that the selection process for the fellowship was based on the “qualifications” of a candidate and not race.

I am writing this, lest should the outcome be unfavorable, you would feel that the Board was acting on prejudice of some kind—prejudice on account of your race, your relations to Howard University, or your preferences for DePauw. None of these matters will be taken into consideration. The application will

be considered only from the point of view of your qualifications.

Kohler's response actually provides evidence of bias faced by African Americans in the field of chemistry which remains a significant challenge in our society. Kohler's suggestion that Julian's application would be evaluated based solely on merit and not race is completely unreasonable considering that Julian left the U.S. to pursue his doctorate in chemistry because of institutional racism. In fact, Kohler suggested to Julian that there was no place for him in chemistry (4). Dr. Julian continued successful research at DePauw until 1935, when the Board of Trustees refused to grant him a teaching appointment (5). Dr. Julian had an incredible career and made significant intellectual contributions to society publishing over 100 papers in high-impact journals and registering over 100 patents. Imagine what additional contributions Julian could have made to society if he did not experience bias and racism throughout his career?



Figure 1. Illustration of Percy Lavon Julian by Giulia Lampis.

Julian had overcome many things in his life at the time he applied for the NRC grant. Born in 1899 in Montgomery, Alabama, Julian attended Alabama schools for African Americans that ended with the 8th grade because of racism, but earned a B.A. (valedictorian and Phi Beta Kappa) from DePauw University in 1920. In 1923, Julian earned an A.M. degree in chemistry from Harvard University, but was denied the opportunity to pursue a doctoral degree at the institution because no Ph.D.-granting university would let him serve as a T. A. (teaching assistant) for White students. Almost a decade later, Julian finally earned his Ph.D. in chemistry.

How can Julian's story of grit and perseverance be used to inspire the next generation of chemists? His story

is a powerful example of how the history of chemistry can be used as an effective tool for engagement of BIPOC (Black, Indigenous and People of Color) communities. Julian's remarkable life and career was brilliantly profiled in the 2007 "Nova" documentary, *Forgotten Genius*, which was rebroadcast on PBS in February 2021 during Black History Month (6). Chemistry faculty could use shorter segments of *Forgotten Genius* in the classroom and align the documentary with an organic chemistry curriculum for student engagement (7). Thus, Julian's remarkable accomplishments and achievements can be used as a "history of chemistry engagement tool" to educate all students with an emphasis on BIPOC communities.

Most recently, a Lawrence Technological University (LTU) student documentary entitled, *Women Untold* was shared on YouTube (8) to celebrate the remarkable achievements of three African American women in STEM (Science, Technology, Engineering and Mathematics) including Dr. Jewel P. Cobb, a biologist and president of an R1 university; Dr. Evelyn Boyd Granville, a mathematician who completed orbital calculations for three NASA (National Aeronautics and Space Administration) missions; and Alice Augusta Ball, a chemist who developed the first viable treatment for leprosy (Hansen's disease) in the early 20th century while a faculty member at the College of Hawaii (now known as the University of Hawaii). The film was written, produced and directed by Marie Anne Torres-Lopez, a recent graduate of LTU (9). *Women Untold* is being used as an educational tool to address equity in STEM.

Born in 1892 in Seattle, Washington, Ball earned two undergraduate degrees from the University of Washington: a degree in pharmaceutical chemistry in 1912 and a degree in pharmacy in 1914. Remarkably, in 1914, Ball also co-authored a research paper in *JACS*. These are tremendous accomplishments from Ball before she earned her master's degree from the College of Hawaii and successfully synthesized and characterized the ethyl esters from Chaulmoogra oil for the treatment of leprosy.

Paul Wermager, Science and Technology Librarian at the University of Hawaii, was interviewed in *Women Untold* and discussed the impact of Ball's remarkable scientific achievements. Wermager shared that Ball's accomplishments really emphasize a "certain level of genius" because the research was completed rather quickly. "She did it in such a brief period of time. We are talking months, not years," says Wermager.

Recently, a Lawrence Tech chemistry professor has utilized the documentary *Women Untold* to engage students enrolled in an organic chemistry course. The students were asked to provide their reflections about *Women Untold* on the final exam for the course. An African American student wrote, “This film made me feel great because it gave people that look like me representation. We are often lost and left out of history so it is great to see the conscious effort of our inclusion.”

An LTU adjunct professor in the Department of Humanities, Social Sciences and Communication also used the documentary in a seminar course focused on science, gender and race. An LTU African American student enrolled in that course stated,

This documentary emphasizes the importance of community, education, and exposure. It shows how people of color, more specifically how women of color have made major contributions to STEM despite the unfair treatment they received. It is vital for young Black girls to know that they are supported and that they, too, are capable of achieving excellence within the STEM community.

Thus, this is anecdotal evidence that students find these types of stories to be compelling.

Narrative films such as *Forgotten Genius* and *Women Untold* are merely two examples educators can use to engage students in the classroom. Additional resources teachers can use as educational tools with their students include the American Chemical Society (ACS) Directory of the National Historic Chemical Landmarks (10) and the National Science Foundation supported ScienceMakers section of The History Makers (11). For example, the National Historic Chemical Landmarks website includes brochures on the careers of Brady, Julian and Norbert Rillieux, a chemical engineer who “revolutionized sugar processing with the invention of the multiple effect evaporator under vacuum (12).” The History Makers includes oral histories on several chemists including Jeannette Brown, who was the first African American woman to earn a M.S. degree in chemistry from the University of Minnesota in 1958. Brown, who worked for both CIBA Pharmaceutical Company and Merck also authored the book, *African American Women Chemists* (13), which also can be used as a resource. Educators could allow their students to conduct research using these engaging resources for a history of chemistry storytelling project. Students could work in teams to prepare a creative infographic or narrative video to celebrate the intellectual achievements of chemists from BIPOC communities.

Chemical & Engineering News (C&EN) recently celebrated African American chemists and chemical engineers in a special issue for Black History Month (14). Professor Paula Hammond, Chair of the Department of Chemical Engineering at the Massachusetts Institute of Technology (MIT) served as guest editor of the C&EN issue and wrote,

We have always been present in the sciences—but now more than ever, we must appreciate and acknowledge the presence of Black people and other people of color. We must find ways to continue to raise our voices and celebrate our work. As a nation, we all benefit from the huge talent gained when all are included in the science enterprise.

A significant and novel aspect of this C&EN special issue is that current African American chemistry graduate students were given a rare opportunity to interview very accomplished and brilliant chemists, thus providing these young chemists a significant platform to expand their network, which is important for a successful career pathway in the chemical sciences.

Professor Hammond, who is a pioneer in drug discovery applications is emphasizing the importance of representation in the chemical sciences. *Forgotten Genius*, *Women Untold*, the ACS Directory of the National Historic Chemical Landmarks, The History Makers and the special C&EN issue celebrating African American chemists are powerful history of chemistry tools that educators and chemistry professors can use to address equity in the chemistry classroom. Including more narratives about African American chemists in the chemistry curriculum is one strategy to help encourage all students to pursue careers in chemistry. Furthermore, this approach can help address barriers to success in STEM including sense of belonging, STEM identity and stereotype threat for students from BIPOC communities. Thus, the history of chemistry *can* and *should* be used as a tool to engage the next generation of chemists.

Acknowledgments

The study was reviewed and approved by the Lawrence Technological University Institutional Review Board (IRB). The author is thankful to Dr. Shannon Timmons and Lawrence Technological University students for contributions to this manuscript. We are thankful to the Harvard University Archives.

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About the Author

Sibrina Nichelle Collins is an inorganic chemist who specializes in STEM education and utilizing pop culture as a pedagogical tool to engage young people in the STEM fields. Her publications in ACS journals include, "What's in Your iPod?" (2010); "Black Panther, Vibranium and the Periodic Table" (2018); "Celebrating Our Diversity: The Education of Some Pioneering African American Chemists in Ohio" (2011); and "Robert Percy Barnes: From Harvard to Howard University (2015)." Dr. Collins is the editor of the new ACS Symposium Book, *African American Chemists: Academia, Industry and Social Entrepreneurship* (2021) and is a full member on the ACS National Historic Chemical Landmarks (NHCL) Subcommittee. She is the Founding Executive Director of the Marburger STEM Center on the campus of Lawrence Technological University.